

ON THE STRUCTURE AND PHYLOGENETIC RELATIONSHIPS OF THE FERN *RADSTOCKIA* KIDSTON

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ABSTRACT. *Radstockia kidstonii* sp. nov. is described from compression specimens contained in ironstone concretions discovered at the Mazon Creek (Illinois) locality. The botanical affinities are suggested as being close to marattiaceous ferns.

THE genus *Radstockia* Kidston (1923) was originally described on the basis of Upper Carboniferous fertile fern-like foliage initially designated as *Schizostachys sphenopteroides* Kidston (1888) and *Hymenotheca beyschlagi* Potonié (1890). Forms placed in the genus are characterized by elliptical fructifications that display a superficial segmented appearance. In *R. sphenopteroides* the fructifications are described and illustrated as being borne either sessile or on short stalks along non-foliar laterals. They may occur singly, in pairs, or in definite clusters at lower levels on the frond.

Two foliar specimens referable to the genus *Radstockia* contained in an ironstone concretion collected at the famous Mazon Creek locality represent the material described in this account. Several additional specimens collected from the same locality and presently deposited in the palaeontological collections at the Chicago Natural History Museum and Illinois State Museum at Springfield were also examined.

The present contribution is concerned with the description of a new species and the interpretative problems which it presents.

SYSTEMATIC DESCRIPTION

Genus *RADSTOCKIA* Kidston 1923

Radstockia kidstonii sp. nov.

Plate 6, figs. 1-4; Plate 7, figs. 2, 3, 5

Diagnosis. Foliar units at least bipinnate, rachis straight, longitudinally striated; foliar laterals alternate, lanceolate to oblong-lanceolate, free on lateral margins. Fructifications elliptical, 2.0 mm long and 1.0 mm wide, pendant and partially embedded in abaxial surface of foliar units; spores spherical, 40-60 μ ; exine thin, levigate.

Holotype. Plate 6, fig. 1. Peabody Museum of Natural History; Yale University, Paleobotanical Collections, No. 1004.

Type Locality. Mazon Creek, Will County, Illinois (U.S.A.).

Stratigraphic occurrence. Francis Creek Shale, Carbondale Formation, Kewanee Group.

Age. Middle Pennsylvanian.

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DESCRIPTION OF SPECIMENS, AND DISCUSSION

The nodule contains portions of two foliar segments (Pl. 6, fig. 1); one specimen shows features of more distal parts, while the second displays characters at more proximal frond levels. From the limited extent of the two specimens it is impossible to determine the branching level represented by the material, although the parallel relationship exhibited between the two foliar parts (Pl. 6, fig. 1) suggests that at least secondary pinnae are represented. Because of the uncertainty, however, the branching foliar axes will be referred to arbitrarily as ultimate, penultimate, and antepenultimate throughout the description that follows.

Foliage. The larger, more distal foliar specimen consists of an antepenultimate axis approximately 9.5 cm. long bearing 15 alternately arranged penultimate axes (pinnatifid pinnules) (Pl. 6, fig. 1). These pinnules are broadly lanceolate to oblong-lanceolate and are constricted where they are attached to the primary (antepenultimate) rachis (Pl. 6, fig. 3). Margins are deeply lobed and free from surrounding foliar units (Pl. 7, figs. 2–3). The rachis is straight and characterized by longitudinal striations (Pl. 6, figs. 1–3) that may represent vascular strands or accompanying sclerenchyma fibres.

The second foliar unit displays features of lower frond levels and consists of a primary axis bearing 7 alternately arranged penultimate axes (Pl. 6, fig. 1). Each of these in turn gives rise to small ultimate axes (pinnules). Lower units of this foliar segment bear alternately arranged, decurrent, obovate pinnules, each of which is subdivided into 3–6 spatulate lobes (Pl. 6, fig. 2). Lobes are uniform in size and each bears a single fructification on its abaxial surface.

Each penultimate axis is supplied by a single prominent vein that departs from the primary rachis, enters the foliar unit, and is further subdivided into smaller veinlets. Whether the individual veins continue to the margin of the lamina cannot be determined from the material. No pinnule lobe contains more than a single vein.

At some levels of the specimen it appears that both fertile and sterile pinnules are present. This, however, is not the case when one carefully removes the matrix surrounding these units. From the present material on hand it appears that fructifications were produced on all of the foliar units.

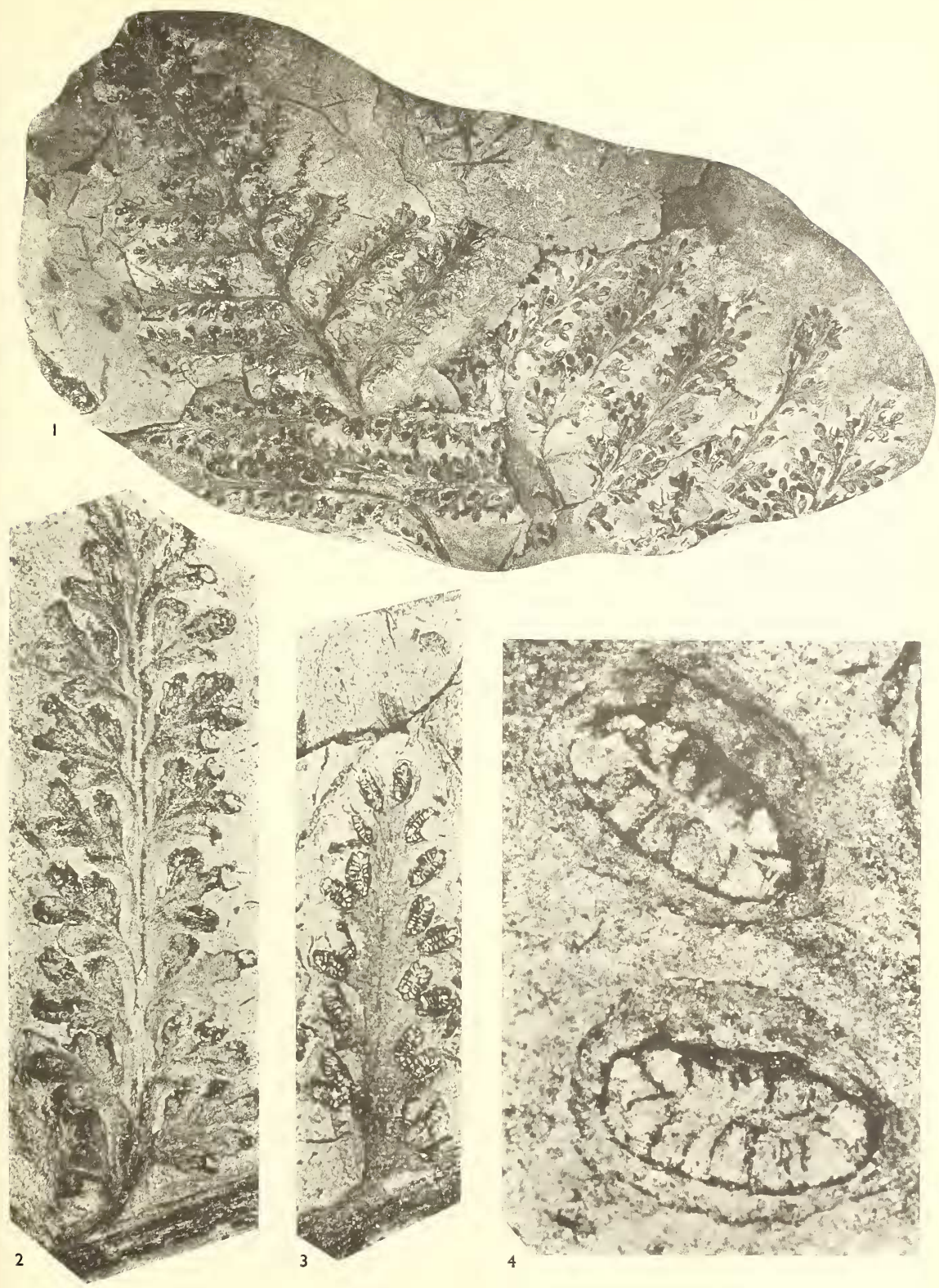
Fructifications. The fructifications of *R. kidstonii* consist of elliptical bodies partially embedded in the abaxial surface of marginal foliar lobes (Pl. 6, fig. 4; Pl. 7, figs. 2–3). Each unit measures approximately 2.0 mm long and 1.0 mm wide in its greatest dimension. Externally each fertile structure is marked by a single conspicuous longitudinal

EXPLANATION OF PLATE 6

Figs. 1–4. *Radstockia kidstonii*. 1, One half of ironstone concretion showing upper (left) and lower (right) portions of two leaves; $\times 1$. 2, Pinna showing lobed configuration of individual pinnules $\times 3$; note striated rachis and pinna base. 3, Fertile pinna near tip illustrating marginal position of synangia, $\times 3.5$. 4, Surface view of two synangia showing linear arrangement of sporangia, $\times 22$.

EXPLANATION OF PLATE 7

Figs. 1, 4. *Marattia alata*. 1, Fertile pinnule; nearly all of the sporangia at the right have dehisced, while those at the left are still intact, $\times 6$. 4, Fertile pinna, $\times 3$; compare with Plate 6, fig. 3. Figs. 2, 3, 5. *Radstockia kidstonii*. 2, Single pinnule showing marginal position of the synangia, $\times 13$. 3, Tip of fertile pinna showing partial fusion of sporangia (arrow), $\times 12$. 5, Spore showing numerous folds of the thin-walled exine, $\times 1000$ (Slide No. 17).



TAYLOR, Carboniferous fern *Radstockia*

